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(54) VULCANIZING MOULD FOR VEHICLE TYRES

(71) I, KARL ZANGL, a citizen of the Federal Republic of Germany, of 8 Munchen 40, Kantstrasse 10, The Federal Republic of Germany, do hereby declare the invention for which I pray that a patent may be granted to me, and the method by which it is to be performed to be particularly described in and by the following statement: —

This invention relates to vulcanising moulds for vehicle tyres.

More particularly, the invention is concerned with a vulcanizing mould for vehicle tyres of the type comprising a first tyre side wall mould section, a second tyre side wall mould section and a tyre tread mould ring subdivided into radially movable guided profile segments, said segments being carried by shoes having outer surfaces which co-operate with a frusto-conical internal surface of an enveloping part so that upon axial relative movement between the enveloping part and the tread mould ring the profile segments are moved radially.

In a known vulcanizing mould of this type the tyre side wall mould sections are arranged horizontally one above the other and one tyre side wall mould section is movable axially in the enveloping part relatively to the other and comprises radially outwardly extended support arms which bear on the radially guided profile segments. Upon closure of the vulcanizing mould the profile segments carried by the sliding shoes move radially inwardly to enclose the tyre blank and after vulcanization they are again moved radially outwardly to free the tyre. At the beginning of the closure movement of the vulcanizing mould the upper side wall mould section is moved downwardly by a pressure cylinder against the side wall of the tyre blank whilst at the same time the radially divided tyre mould segments move downwardly and radially outwardly relative to the enveloping part. As soon as the sliding shoes meet the side wall mould section in the course of the further closure movement a heating bag is introduced into the tyre blank and subjected to a high internal pressure.

Particularly in the case of large tyres, for example truck tyres, the force exerted by the pressure cylinder on the side wall mould sections may be up to 20 tons or more. Under this high load the sliding shoes of the profile segments must be moved by the sliding faces of the enveloping part in the radial direction inwardly towards the tyre. Due to this high load and the resulting high friction at the sliding faces of the shoes, the sliding faces of the side wall mould sections and the sliding faces of the enveloping part are damaged by rubbing even after a short time, making the entire vulcanizing mould useless.

To prevent this damage to the sliding faces by friction it is already known to incorporate portions of low friction material into the sliding faces. The sliding shoes and other portions of the vulcanizing mould are for this reason in some cases made from steel and hardened. Nevertheless, in the course of time even with these constructions damage arises at the sliding faces and the expenditure necessary greatly increases the production costs of the radially divided vulcanizing moulds.

The problem underlying the invention is to provide a vulcanizing mould of the type referred to in which the frictional load of the sliding faces is obviated and which therefore has a longer life.

According to the invention there is provided a vulcanizing mould for vehicle tyres comprising a first tyre side wall mould section, a second tyre side wall mould section and a tyre tread mould ring subdivided into radially movably guided profile segments, said segments being carried by shoes co-operating with the tyre side wall mould

sections and having outer surfaces which cooperate with a frusto-conical internal surface of an enveloping part so that upon axial relative movement between the enveloping part and the tread mould ring the profile segments are moved radially, in which at least one of each pair of cooperating faces of the two tyre side wall mould sections, the enveloping part and the shoes incorporates a pressure roller unit which comprises at least one roller loaded by a pressure spring so as to project beyond the respective face in which the roller unit is incorporated, the loading of the or each roller by its pressure spring being such that the pressure roller is retracted into the respective face in which it is housed when the mould is closed, so that sliding contact between the cooperating faces of the said mould sections, enveloping part and shoes occurs only as the mould approaches the fully closed condition.

The invention will be explained in detail hereinafter by way of example with reference to the accompanying drawings, wherein:

Fig. 1 shows an axial cross-section through a vulcanizing mould according to one embodiment of the invention, in which the left half of the Figure shows the mould in the open state and the right half of the Figure shows the mould in the closed state, and in which several different versions of pressure roller units are illustrated;

Fig. 2 is a plan view of one embodiment of a pressure roller unit employed in the mould of Fig. 1;

Fig. 3 is a partially longitudinal section view along the line III-III of Fig. 1 through a pressure roller unit according to Fig. 2 built into the upper side wall mould section;

Fig. 4 is a cross-sectional view of the embodiment of the pressure roller unit according to Figs. 2 and 3;

Fig. 5 is a partially longitudinally sectioned view along the line V-V according to Fig. 1 of a further embodiment of a pressure roller unit built into the enveloping part;

Fig. 6 is a cross-section through the embodiment of the pressure roller unit according to Figs. 2 and 3 which is incorporated into the lower side wall mould section in the left half of Fig. 1;

Fig. 7 is a longitudinal section along the line VII-VII of a further embodiment of the pressure roller unit which is directly incorporated into a recess in the lower side wall mould section in the right half of Fig. 1;

Fig. 8 is a plan view of the embodiment of the pressure roller unit according to Fig. 7;

Fig. 9 is a longitudinal section through a further embodiment of a pressure roller unit having four pressure rollers which are incorporated into a recess in the lower side wall mould section;

Fig. 10 is a plan view of the embodiment according to Fig. 9;

Fig. 11 is an embodiment of a sliding shoe in which the shoes are incorporated in bores or milled-out portions or recesses in the sliding faces.

Fig. 1 shows an example of a vulcanizing mould according to the invention which comprises a first tyre side wall mould section 100, an enveloping part 200 and sliding shoes 300 which are guided with the aid of guide pins 240 provided at intervals on the inside of the enveloping part 200, and a second tyre side wall mould section 400. The first side wall mould section 100 is separate from the enveloping part 200 in which the sliding shoes 300 are guided. Tyre tread profile segments 300*a* are secured to the sliding shoes 300 and form a tyre tread mould ring. The shoes 300 have outer surfaces consisting of frusto-conical segments inclined to the axis of the enveloping part which cooperate with a frusto-conical internal surface of the enveloping part 200.

Disposed on the first side wall mould section 100 are support arms 100*a* for suspending and radially guiding the sliding shoes 300 with the tread profile segments 300*a* mounted thereon. These support arms 100*a* each have a guide slot 101 in which a stud 301 is guided, the stud 301 having a screw-threaded portion by means of which it is attached to the sliding shoe 300.

The support arms 100*a* are arranged around the periphery of the mould section 100 in alternation with the guide pins 240, and the number of guide pins and support arms may be such that in a given axial section, such as that shown in Fig. 1, a guide pin 240 on the left half of the section is in the same plane as a support arm 100*a* on the right half of the section.

Built into the enveloping part 200 are the sliding shoes 300 with the guide pins 240. The guide pins 240 in the enveloping member 200, as well as guiding the sliding shoes 300, also guide the first side wall mould section 100 as it moves within the enveloping part 200.

In the left half of Fig. 1 the vulcanizing press is shown in the half-closed state in which the sliding shoes 300 rest upon the second side wall mould section 400 and are spaced from the tyre wall mould carried thereby. In the right half of said Figure the vulcanizing mould is shown in the completely closed state in which the shoes 300 and the tread profile segments 300*a* are in contact with the radially outer surfaces of the said tyre wall mould sections 100 and 400.

The mode of operation of the illustrated vulcanizing mould is as follows:

At the start of the closure movement of the vulcanizing press the first side wall mould section 100 is moved downwardly relatively to the enveloping part 200 by means of a pressure cylinder (not illustrated) against the tyre side wall whereby the sliding shoes 300 together with the profile segments 300*a* are moved downwardly and radially outwardly relative to the enveloping part 200.

As soon as the sliding shoes 300 meet the second tyre side wall mould section 400 a heating bag (also not shown) is brought in the course of the further closing movement into the tyre which is loaded by a high pressure within the bag.

To obviate friction between the sliding shoes 300 and the cooperating faces of the tyre side wall mould sections 100 and 400 and the enveloping part 200 pressure roller units 104, 204 and 404 are incorporated in these faces. The pressure rollers of these units are spring-loaded, for example with the aid of Belleville springs, in such a manner that when the vulcanizing mould is not closed they project by about 1 mm. from the cooperating faces of the side wall mould sections 100 and 400 and the enveloping part 200. This gives rise to a gap of, for example, 1 mm. between these faces, so that sliding friction between the shoes 300 and faces relative to which they move is avoided while the rollers project from these faces, minimising wear of the shoes and said faces, as illustrated in the left half of Fig. 1.

Only at the final instant of closing of the heating press does the load on the mould sections 100 and 400 and the enveloping part become so high that the pressure rollers of the units 104, 204 and 404 are pressed against their loading springs and retracted into the faces in which they are housed, so that the sliding shoes come to bear on all the sliding faces as illustrated in the right half of Fig. 1.

The load exerted by each shoe 300 on the pressure rollers of the pressure roller units 104, 204 and 404 before yielding of the Belleville springs occurs may be 3 tons or more, dependent upon the strength of the roller-loading springs, which may be selected according to any desired roller loading. The loading springs should be able to take up a load about 50% higher than that actually required to ensure that sliding contact does not occur between the relatively moving faces of the shoe and the mould sections 100 and 400 and the enveloping part 200 during closing or opening of the mould, except in the final closing movement as the mould approaches the fully closed condition.

Figs. 2 to 11 show details of different pressure roller units for use in the mould according to the invention. Figs. 2, 3 and 4 show a plan view, a longitudinal section and a cross-section respectively of a pressure roller unit 104. This pressure roller unit 104 is mounted in the upper side wall mould section 100 in the left half of Fig. 1 in a pressure-resistant housing 104*a* located in a recess or milled-out portion. The roller unit 104 comprises two pressure rollers 104*f* which are mounted on a common bearing pin 104*e*. The bearing pin is non-rotatably mounted in a roller support 104*d* which is in turn biased with respect to the pressure-resistant housing 104*a* by means of pressure springs 104*b*. Adjustment screws 104*c* which are displaceable in the longitudinal direction in the pressure-resistant housing 104*a* and are screwed into the roller support 104*d* serve to preset the position of the roller support 104*d* in the unloaded state.

The complete housing 104*a* can be mounted with the aid of mounting screws 104*g* in recesses in the tyre side wall mould section 100 or 400, as shown in Figs. 1 to 4.

Fig. 5 shows a pressure roller unit 204 suitable for mounting in the enveloping part 200, corresponding parts being denoted by the same reference numerals. Fig. 5 is a longitudinal section along the line V-V in the right half of Fig. 1 and the pressure roller unit illustrated in this Figure comprises a single wide pressure roller 104*f* having a roller support 104*d* which is partially guided in a bore 204*i* in the enveloping part 200, as shown in the right half of Fig. 1. The roller support 104*d* is further biased by pressure springs 104*b* with respect to the pressure-resistant housing 104*a* which is mounted with mounting screws 104*g* on the enveloping part 200.

Fig. 6 shows a cross-sectional view of an embodiment of the pressure roller unit which is incorporated in the lower side wall mould section 400, and shown in the left half of Fig. 1. Said pressure roller unit comprises a housing 104*a* which can correspond to the housing 104*a* of the pressure roller unit in the upper side wall mould section 100 and which is accommodated completely in a recess 404*i* in the lower side wall mould section 400, as illustrated in Fig. 6.

Figs. 7 to 10 show a further embodiment of the pressure roller unit which does not have its own housing and the roller support 104*d* of which is directly mounted in a recess 404*i* in the lower side wall mould section 400 and biased with respect to the latter by means of Belleville springs 104*b*, two screws 104*c* again being provided for initial adjustment of the position of the pressure rollers in the unloaded state. The pressure springs 104*b* are disposed in depressions in the recess 404*i*. This construction of the pressure roller unit 404 makes it possible

to dispense with a separate pressure-resistant housing. Fig. 8 shows the form of the milled-out portion or recess 404*i* and the arrangement of the pressure roller unit therein.

Figs. 9 and 10 show a somewhat modified version of a pressure roller unit without a separate pressure-resistant housing. This pressure roller unit is mounted in a recess 504*i* in the lower side wall mould section 400 and is again biased with respect to said section by means of Belleville springs 104*b*. In this case two separate roller support members 504*d* are used which are mounted in circular portions of the recess 504*i*. The pressure roller unit shown in Figs. 9 and 10 comprises a relatively large number of small pressure rollers and is therefore particularly suitable for use in thin-walled sections of the vulcanizing mould, that is, not only for the lower side wall mould section but equally well for the upper side wall mould section and the enveloping part.

The recess necessary for this pressure roller unit can be made very easily because only two circular bores are required which are connected by a slot which can be milled in simple manner in the corresponding portion of the vulcanizing mould.

The use of the pressure roller units described obviates friction at all the sliding faces and consequently damage to the vulcanizing moulds at said faces is obviated and their life increased.

It is pointed out that the illustrated arrangement of the pressure roller unit is not the only possible one and that any of the pressure roller units according to Figs. 2 to 10 may be used both for the upper and for the lower side wall mould section and/or the enveloping part. The incorporation of the various pressure roller units at certain points of the vulcanizing mould illustrated in Fig. 1 is intended only as an illustration.

It is of course also possible to incorporate the pressure roller units illustrated in Figs. 2 to 10 in the sliding shoes 300 themselves, as illustrated in Fig. 11. Fig. 11 shows an enlarged fragmentary section of the left-half of Fig. 1; in this case pressure roller units are incorporated into all the sliding faces of the shoe 300. The pressure roller units illustrated in this Figure correspond substantially to those illustrated in Figs. 3, 4 and 6 although it will be apparent from the preceding description any of the pressure roller units may also be used in the shoe 300 according to Fig. 11.

The shoe 300 shown in Fig. 11 has corresponding recesses or milled-out portions which serve to receive the pressure-resistant housing of the pressure roller unit. Of course, it is also possible to incorporate the pressure roller units without a separate pressure-resistant housing in the sliding shoe, as illustrated for example in Fig. 7 for the lower side wall mould section 400.

WHAT I CLAIM IS: —

1. A vulcanizing mould for vehicle tyres comprising a first tyre side wall mould section, a second tyre side wall mould section and a tyre tread mould ring subdivided into radially movable guided profile segments, said segments being carried by shoes cooperating with the tyre side wall mould sections and having outer surfaces which cooperate with a frusto-conical internal surface of an enveloping part so that upon axial relative movement between the enveloping part and the tread mould ring the profile segments are moved radially, in which at least one of each pair of cooperating faces of the two tyre side wall mould sections, the enveloping part and the shoes incorporates a pressure roller unit which comprises at least one roller loaded by a pressure spring so as to project beyond the respective face in which the roller unit is incorporated, the loading of the or each roller by the pressure spring being such that the pressure roller is retracted into the respective face in which it is housed when the mould is closed, so that sliding contact between the cooperating faces of the said mould sections, enveloping part and shoes occurs only as the mould approaches the fully closed condition.

2. A vulcanizing mould according to Claim 1, in which the or each pressure roller of each roller unit is mounted in a roller support which is biased by the pressure spring with respect to a pressure-resistant housing, the housing being replaceably mounted in a recess in the respective face in which the roller unit is incorporated.

3. A vulcanizing mould according to Claim 1, in which the or each pressure roller of each roller unit is mounted in a roller support which is mounted in a recess in the respective face in which the roller unit is incorporated and is biased with respect to the corresponding sections of the vulcanizing mould by means of the pressure spring or springs.

4. A vulcanizing mould according to any one of the preceding claims, in which the pressure springs of the roler units comprise Belleville springs.

5. A vulcanizing mould according to Claim 2 or Claim 3, in which the or each roller in each pressure roller unit is mounted on a bearing pin and the roller support is displaceable in a direction perpendicular to the axis of the bearing pin by means of an adjustment screw which enables the biasing force of the pressure spring or springs to be adjusted.

6. A vulcanizing mould according to any one of the preceding claims, in which each pressure roller unit has a bearing pin on which two or more rollers are mounted and two or more roller supports are arranged

side by side in the axial direction of the bearing pin, the said supports being housed in recesses or bores in the respective face in which the roller unit is incorporated and being acted upon by respective pressure springs.

7. A vulcanizing mould according to any one of the preceding claims, in which the pressure roller units are incorporated in milled-out portions or recesses in each sliding shoe at all faces thereof which cooperate with the two tyre side wall mould sections and the enveloping part.

8. A vulcanizing mould for vehicle tyres substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

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1409008 COMPLETE SPECIFICATION

6 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

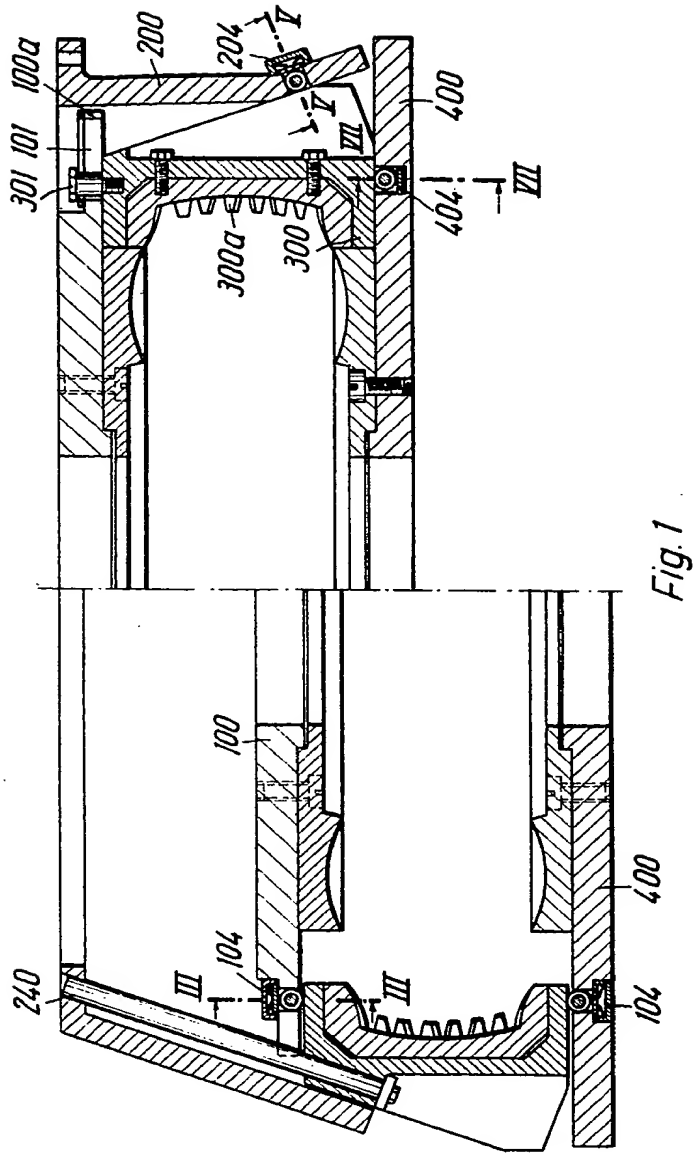

Fig. 1

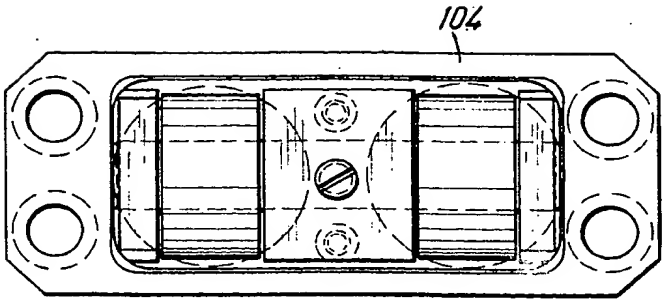

Fig. 2

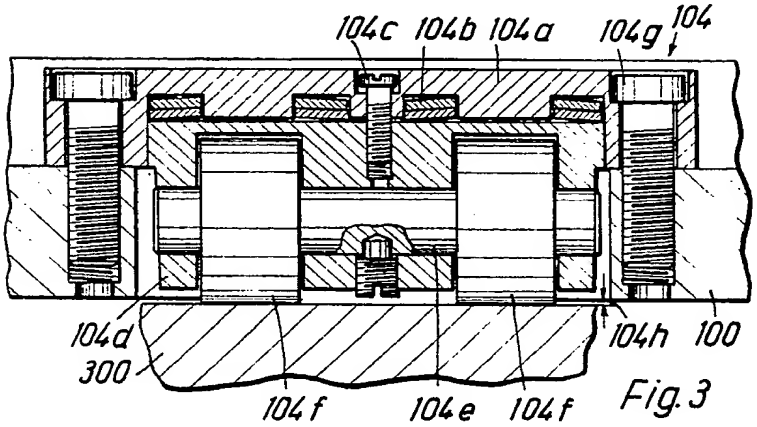

Fig. 3

1409008 COMPLETE SPECIFICATION
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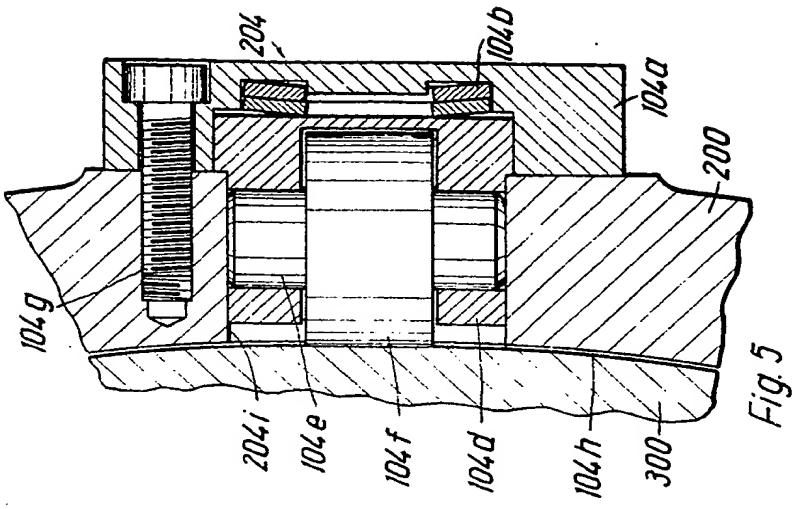

Fig. 5

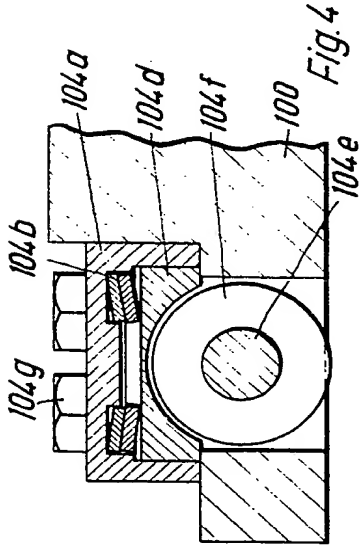

Fig. 4

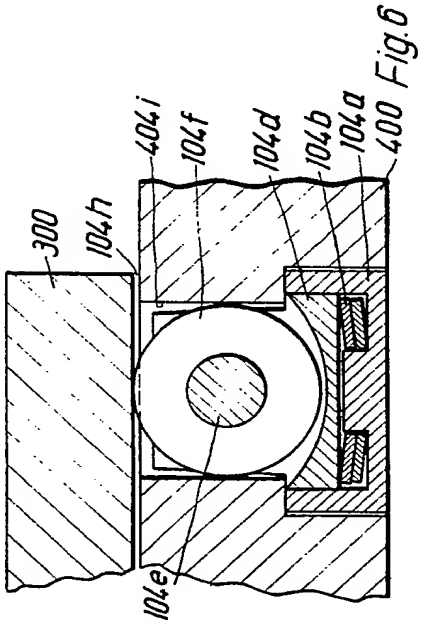

Fig. 6

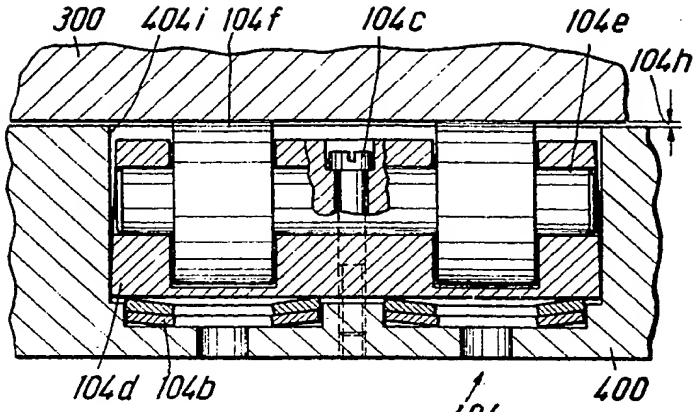

Fig. 7

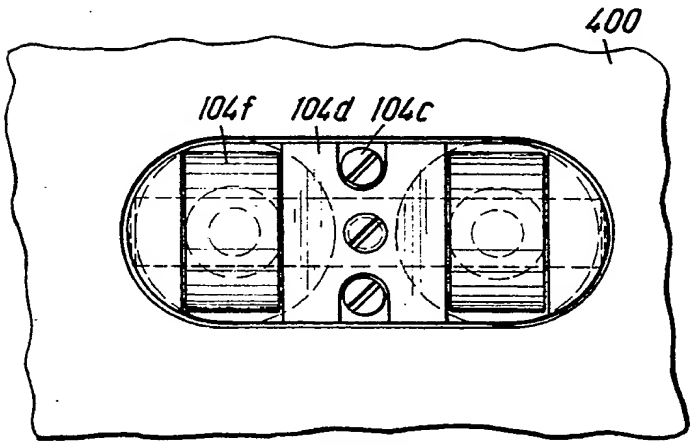

Fig. 8

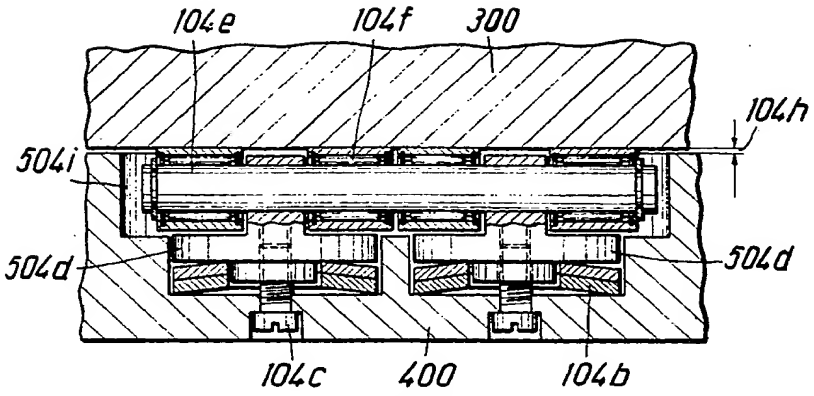

Fig. 9

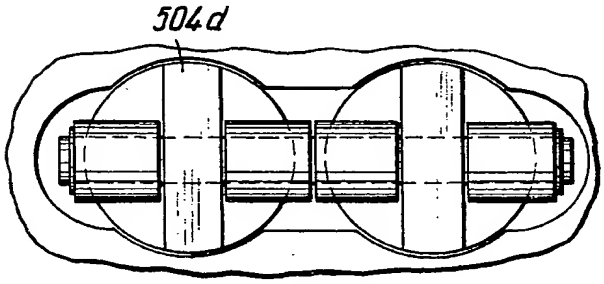

Fig. 10

1409008 COMPLETE SPECIFICATION
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Sheet 6

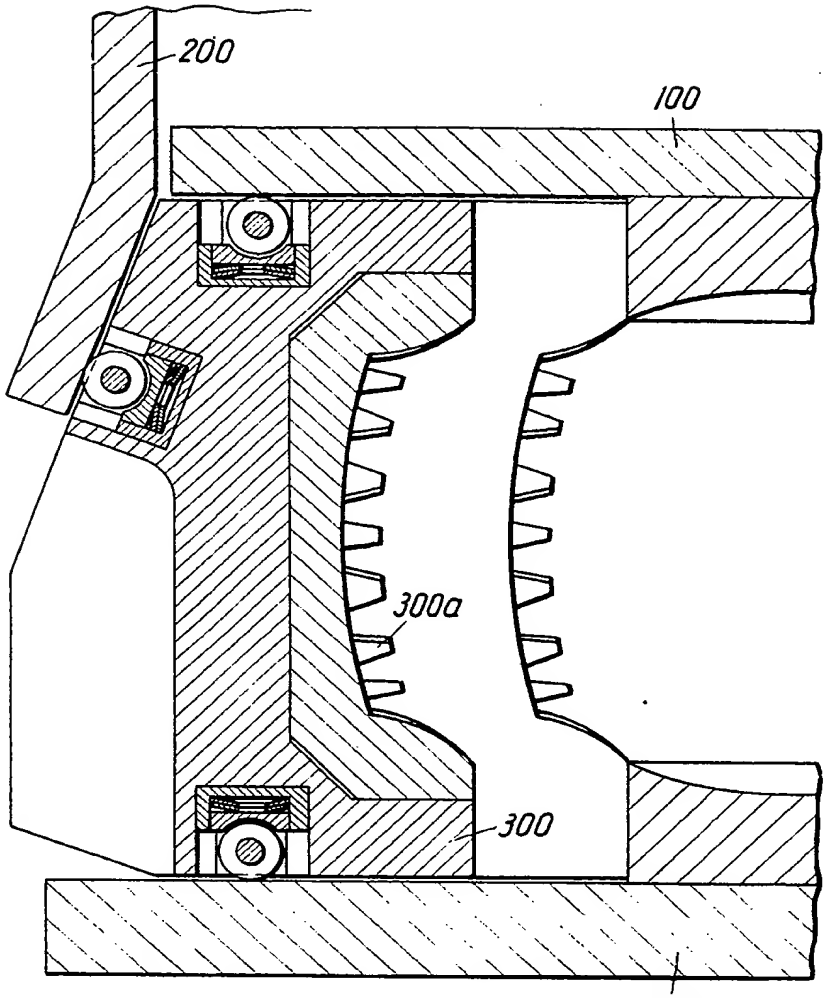

Fig.11